method was followed by an appreciable number of recurrences. Later on he made the Bassini on one side and the Ferguson on the other, and now he does the Ferguson operation altogether. But the principles mentioned must be present. Supposing the surgeon wishes to make an artificial vagina, or to keep open a rectum in which there is a stricture, he can not do it unless he lines it with mucous membrane. This principle does not always apply in umbilical hernia in the adult. In the infant where the canal is actually circular, in 97 per cent. of hernia in the adult, where the abdomen shortens umbilical hernia in the adult, where the abdomen shortens laterally, the opening is no longer circular, but becomes elongated and the principle is abolished. These herniæ do not close by simply removing the sac.

HEREDITY AND ENVIRONMENT AS FACTORS IN THE LIFE AND DISEASES OF CHILDREN.*

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In the first chapter of Genesis and the eleventh verse it is written: "God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit, after his kind, whose seed is in itself upon the earth, and it was so." In the twenty-first verse: "God created great whales and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind." In the twenty-fourth verse, also: "God said, Let the earth bring forth the living creature after his kind, cattle and creeping thing and beast of the earth after his kind, and it was so." And to confirm these statements, it is reiterated, in the twenty-fifth verse that: "God made the beast of the earth after his kind, and the cattle after their kind, and every thing that creepeth upon the earth after his kind; and God saw that it was good." Thus it was a fixed law that in order to avoid confusion, every living thing, whether it be plant or animal, shall produce offspring after its own kind, thus establishing the law of heredity, and also forming at the same time, abundant proof for those who believe in the so-called bathmic evolution.

While no one, from scientist down to the most ignorant casualist, denies the matter of heredity, or that we expect offspring to be like their ancestors, yet many biologists, as well as psychologists, have devised different and even antagonistic theories to account for heredity, and its correlative factor, environment. The firmness of the belief in heredity and its influential factors in determining offspring are especially shown when there appears an apparent exception to the law, that like produces like, or what we call variation. For instance, if an auburn-haired child with blue eyes makes its appearance in a family of dark-haired, dark-eyed parents and brothers and sisters, it causes general comment, and should all questions of legitimacy be settled favorably to the suspected, inquiry will at once be made as to the matter of atavism or reversion to previous ancestors. In order, however, that one may understand, as we proceed, a few definitions may not be out of the way. Heredity is usually defined as the law that accounts for the production of offspring like the ancestors, but as we have occasionally a variation from the ancestors, we usually study heredity and variation together. Variation is usually due to some disturbing factor, which modifies the

workings of the law. Weismann, a German biologist of note, held to the theory that only inherent qualities can be transmitted to offspring, acquired characteristics and habits can not be transmitted. According to him, parents are merely trustees to hand down their commingled stocks to their offspring. The effect of training and education of parents can not be inherited by the children. This differs from the saying of the late Oliver Wendell Holmes, that if you want to make a scholar out of a child its training must begin 200 years before it is born. From bad stock, according to Weismann, can come only bad offspring, and if a member of such stock, through special training and education and the result of favorable environment, should prove an exception to his family, yet his offspring will inherit but the old taint, and none of his acquired good qualities. Darwin's views are similar, primarily stated, but when we read his "Descent of Man," his theory of evolution dependent on the two great factors, sexual selection and environment, we must see that in practice, Darwin believes in the transmission of acquired, as well as of inherent, characteristics.

The English philosopher, Locke, believed that all people are endowed with the same amount of qualities or inherent characteristics, and that with the same amount of work and application all could achieve the same results in any field. The very opposite views are held by Galton, as we see in his "Faculty and Education" and his great work on "Nature and Nurture." The latter is probably nearer right than Locke. Haeckel has views similar to Darwin's, and Lamarck is diametrically opposed to Weismann, and many instances can be quoted to prove his contentions. For instance, the matter of telegony is one of them, and, while mentioning the word, I will also define it: Telegony is the reversion in children of one parent to characteristics of a former mate. For instance, a mare, having been bred to a quagga, an animal striped similarly to a zebra, later, when bred again to a horse, produced a colt with the stripes of a quagga. So, also a bitch, that was bred with a mongrel had pups characteristic in color and other qualities similar to the mongrel, yet when bred to a pure-bred animal of her own kind gave birth to a litter, some of which were marked like her former mongrel mate. Numerous examples could be mentioned which can not be gainsaid. On the other hand, we know that the rite of circumcision has been practiced among the Jews for several thousands of years, yet no Jewish boys are born without foreskins. Shepherds, who amputate the tails of all lambs, and have done so for centuries, must still repeat the process to-day, as so far no bobtailed sheep are born. But, *per contra*, Brown-Séquard, who did many bizarre things and who created artificial epilepsy in guinea-pigs, had the pleasure of seeing epilepsy develop in the offspring, even to the third generation.

Among dogs, retrievers and setters seem to have transmitted their acquired education to their offspring, as a well-born retriever will invariably practice retrieving without being taught; hence it seems the quality of retrieving, originally taught his ancestors, was in this instance transmitted to him. Weismann to the contrary, notwithstanding. Brown-Séquard's epilepsy experiments form a valid excuse now for asking the question that will interest this Section, namely, Are diseases, like certain traits, inherited, that is, transmitted from ancestor to posterity? And, if so, have these diseases always existed in this particular tribe or family, or were they first acquired and then transmitted? If the latter, how can Weismann be right, who says acquired characteristics can

* Read at the Section on Diseases of Children of the American Medical Association, at the Fifty-seventh Annual Session, June, 1906.

not be transmitted? Is there a taint of fatalism in such views that declare we can not change anything permanently, so that hereafter when a certain happy result is accomplished by environment, education and training we can not entrust it to reproduce itself, but must continually keep up the work of the same environment and training? If this were so, what is the use of the practice and study of eugenics, except as they repay us in immediate results?

According to the laws of heredity, if a father and a mother were in all respects exactly alike, and not taking into account theoretically their ancestors, then their offspring would exactly resemble them, and also each other. But this assumption is only to help us form the law of coefficients of heredity. Namely, if the quantity of a certain trait in the father were assumed to be one, and the same in the mother, we would expect the child to have the same trait in the same quantity, namely, one. But if one parent have this trait and the other only one-half, then we would expect the child to have only three-fourths, provided there is no prepotency existing in one parent or another in this especial trait. But—yes, but—any given person has, as far back as the tenth generation, a totality of 1,024 ancestors, including his parents, as can easily be shown by calculation. Now, all of these 1,024 have added their share of hereditary influences to his physical, mental, moral and psychical make-up, not to mention telegonic and bathmic influences, plus all the environments of Lamarck, Darwin and Haeckel. Mention of the word bathmic demands some definition. The word is from the Greek bathmos or basic; it refers to certain basic or inherent principles or characteristics existing in every individual to reproduce its own and to revert back to the reproduction of its primitive types, when not trammelled by environment or education or training. An illustration of bathmic evolution exists in the begonia and some other plants, a leaf of a begonia when planted in the ground takes root and grows and reproduces the entire plant, thus showing an inherent growth force. To illustrate more distinctly, no matter what seed is sown and under what circumstances or conditions, if it grows and reproduces at all, it will produce the same kind of organism that gave rise to the seed. By environment and education or training the horticulturist produced many varieties of apples by processes known as budding, grafting or pollenization, yet seed planted from these desirable varieties will revert to the original species, and all the acquired qualities will eventually be lost. Will this also be the case with human stock, rescued by social purity societies, prison-reformers, eugenic matings of the social reformers, education of the proletariat, intermarriage of the plebeians with the patricians? If so, it will give the lie to those who claim that the continuous influx of Europeans, most of whom come from the lowest class of peasantry, is a direct benefit to the social melting pot of the earth, the United States of America, where live the greatest people on the earth—consisting of more than your 1,024 ancestors? Or have I taken for granted an aphorism whose truth is questionable and belongs not to the real truths, but the assumed ones, the *argumentum ad hominem*? If so, I have taken less for granted than many things on which rest a great number of the most ultra-scientific theories. Much of this reminds one of the contents of the witches' caldron in Macbeth:

"Round about the caldron go;
In the poisoned entrails throw
Toad that under coldest stone,
Days and nights has thirty one.

Sweltered venom sleeping got,
Boil then first i' the charmed pot;
Double, double, toil and trouble;
Fire burn and caldron bubble,
Fillet of a fenny snake,
In the caldron boil and bake;
Eye of newt, and toe of frog,
Wing of bat and tongue of dog,
Adder's fork and blind worm's sting,
Lizzard's leg and owlet's wing,
For a charm of powerful trouble,
Like a hell broth boil and bubble;
Scale of dragon, tooth of wolf,
Witches mummy, maw and gulf
Of the raving salt-sea shark,
Root of hemlock, digged i' the dark,
Liver of blaspheming Jew,
Gall of goat and slips of yew,
Slivered in the moon's eclipse,
Nose of Turk and Tartar's lips,
Finger of a birth-strangled babe,
Bitch delivered by a drab,
Make the gruel thick and slab,
And thereto a tiger's chaudron,
For the ingredients of our caldron,
Cook it with a baboon's blood,
Then the charm is firm and good."

This is quite a mixture and smacks of polypharmacy, yet it is a mild and harmless mess when compared to the 1,024 that come to our shores as factors in that product, called the elect of the earth—Uncle Sam's children. Is it a wonder we still have wars, murders, theft, defalcation, social evils, rebate evils, insurance swindles, and crime in high places and low, when "the butcher, the baker and the candle-stick maker," aye, far worse indeed, commingle in marriage to form the ancestors of the coming nations of the earth? Man still makes "countless thousands mourn" as in the days of the plowboy of Ayr. My ultra-scientific friends may accuse me of making a mess of scientific things and poetry yet poetry is the very spirit of truth, and of poet and scientist the former has often proved the greater seer. I might prate more wisely of the pangenesis of Darwin with his theory of gemmules which collect in the reproductive cells, and may be called "undeveloped atoms," and how they are supposed to be transmitted from parent to child, where they are said to remain in embryo undeveloped and later under suitable conditions develop and give so-called transmitted characteristics to the offspring, the theory that helped Darwin out of many rough places in formulating his theories of heredity, but, as no one yet has seen one of Dalton's atoms, so no one has seen Darwin's gemmules, or undeveloped atoms, so you see even the scientist goes begging at times for hypotheses when he is short on facts. Weismann, dissatisfied with the theory of gemmules, conceived that a germ-plasm, which was supposed by him to be a substance contained within each cell and a part of which after transmission to the offspring was never entirely used up, but transmitted to the next generation, and so on, in order to account for the continuity of the germ-plasm through ages and generations. We know cells, we know their nuclei or nucleoli, and their network and frame work, but we have never known germ-plasm, that has hitherto escaped us, though we courted it with aniline stain and acetic acid. One may as well quote poetry as such science.

The same is true of the theory of gametes and the applications of algebra, the formulæ of the calculus to establish the variant coefficients, the study of hypothetical zygotes, the elusive doctrine of Lloyd Morgan's metakinesis, the "something which is not yet consciousness, but which may develop into consciousness." All

these theories and others too numerous to mention are often met with solid cold facts that are hard to harmonize. We may ask why do we continually seek to improve existing conditions, why teach or instruct, if all of it must continually be done over again, if nothing good has a continuance or abiding place, when we must fear overeducation and overtraining in one as much as undertraining in another? Will our striving ever attain some permanency? It does seem so at least! Can we improve bad stock without at the same time causing deterioration of the good stock when we practice sexual selection? Has the good and beautiful any prepotency over the bad and the ugly? Is an average better than two classes, the good and the bad? Or must we in so-called stirpiculture finally aim at the destruction of the bad by the good? Is not that a somewhat questionable procedure by the good? One is reminded, even if not forcibly of a conversation between an impertinent inquirer into the history of the ancestry of Dumas the younger. Said he: "I understand your father was a mulatto?" "Yes," answered Dumas. "And your grandfather?" Dumas answered, "He was a negro." "And his ancestor?" still probed the inquisitor. "He was an ape," said Dumas; "you see my ancestry begins where yours ends." Also another incident comes to my memory in the matter of improving our race by destroying the bad and vicious. Long ago I read an investigation into the doctrine of original sin by that great Bostonian who invented the hub around which the universe spins, the story of Elsie Venner, in which the question arose as to the right to exist, for instance, of the cats and the rats, yet the especial object in life of the cats was to destroy the rats. Did he mean that the good should destroy the bad? So far as the laws of Nature are concerned, the matter of pity has no place in her code. If an innocent babe should violate the law of gravity on a window sill of one of our skyscrapers, no good angel will interpose and intercept the falling innocent to prevent its horrid death and thus stay a tragedy in the breast of its mother. So, I think, when Nature herself is slow in making selection and survival of the fittest, man should hasten the process by the aid of environment. It may be foreign to the letter of this paper to include what I wish to say to you, but it may be useful to do so, and utility may be a reasonable excuse for any transgression of a theory. I think it would be right if, by legal enactment, the defective, the degenerate and the vicious could be so treated that procreation from such stock would be an impossibility. The researches of Dugdale remind us of the notable case of the Juke family of New York, who furnished in their progeny 1,200 people, most of whom were paupers, thieves or prostitutes, and who cost the Empire State, in trials, prisons and almshouse relief, no less than one and a quarter million dollars. How much property, misery, crime, sorrow and worry could have been saved if that old fisherman, drunkard and libertine, Juke, could have been emasculated before he set up that dynasty of crime and vice so rich in offspring, the spawn of corruption?

Our adolescent youth should have it impressed on them not to form partnerships in life with the descendants of the vicious, for it is literally true that "as we sow, so shall we reap." If parents would exercise as much of their prerogative in selecting marriage partners for their children from this standpoint as they usually do from that of worldly means and social standing, our race would be more desirable in future years than it has

ever been since the disobedience of the first pair. I am sure our pseudo-reformers may mean well, but certainly do much harm, when they train the semi-idiotic and the feeble-minded and attempt the reformation of vicious criminals—the vicious youths in our reformatories and others—if they do not at the same time see to it that these hordes do not reproduce their own kind as the sands of the seashore. In doing as they now do, they only arouse their Nemesis, as Frankenstein created the monster without heart or conscience, that strangled without compunction, all that was dear to him on earth. The educated imbeciles and reformed criminals breed, if not prevented, like flies and rats. They even marry the good, if not the wise, who know not their antecedents, and thus dilute the human race with vice and degeneracy.

In the study of heredity we observe that the biologist and physicist often overlap boundaries with the psychologist, yet it is not speculating in theories that will lead us out of the realm of error into that of light so much as aiming at practical results in the study of child life that will produce the ideal boy and man, as well as the perfect girl and woman. The human embryo originates from a spermatozoon that differs very little from that of the horse, dog, ape, worm, fish or fowl, and in its history of prenatal life apparently passes through all the evolutionary forms of the various lower animals. As an analogue we may say the child in its growth and social development passes up through all the various stages of civilization from the most brutal and primitive savage to the highest forms of ideal existence. May this not by a form of atavism account for some of the usually unaccountable origins of crime, murders, thefts, the desire for tramping, sea roving, etc.? I ask, but do not answer. Despite the dictum of Weismann, that acquired characteristics are not transmissible from ancestor to offspring, the consensus of opinion of philosopher, philanthropist and statesman, of scientist and sage, is that Weismann is wrong so far as the practical results of education and training are concerned. If so, it gives pediatricists courage to go on in their good work, not only in combating and treating diseases in children, but in preventing, by proper advice and training, disease tendencies, be they diseases of the body only or those of the mind and psychic existence. These, then, are the lessons we can draw from such a study, whether we hold with Weismann that by eternal vigilance we shall obtain the prize or by holding the converse we can, by a joyous optimism, hope to see the fruits of our labors accumulate in that perfect man and woman we may see, even though only from the Pisgah of our hopes.

If Weismann be correct, if the bad by the environments of education and training can be made good, though bad stock can not be converted into good stock, then we see how grave a responsibility rests at present on every one who has to consider the problems relating to state endowments of education, the making and administering of poor laws, the conduct of charities which yearly spend immense sums. In all these problems the blind social instinct and the individual bias form strong factors in our judgment. Yet these very problems are the ones which, affecting the whole future of society, its stability and efficiency, require us, as good citizens, to understand and to obey the laws of healthy social development. The examples we have considered will not prove futile, nor its lessons worthless, even should Weismann's views, after all, be wrong. It is plain that in social problems such as I have referred to, the laws of

heredity, whatever they may be, must certainly influence our judgment. The conduct of parent to child and of society to all its members can never be placed on permanent bases unless regard be paid to what science has to tell us of the fundamental problems of inheritance. The theory of evolution is not merely a passive intellectual view of Nature; it applies to man in his communities as it applies to all forms of life. It teaches us the art of living, of building up stable and great nations, and is as important to statesmen and philanthropists in council as for the scientist in his laboratory or the naturalist in the field. The laboratory experiments of a biologist may have a greater weight in practical life than all the theories of Plato, Hegel or Schleiermacher.

The scientific classification of facts, biologic or historical, the observation of their correlation and sequence, the resulting absolute as opposed to individual judgment, these are the sole means by which we can reach truth in such a vital social question as that of heredity.

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DISCUSSION.

DR. F. A. RHODES, Pittsburg, said that notable writers are diametrically opposite in their conclusions. The question will never be solved until we are able to tell what life is. Some years ago he formulated the definition that animal life (the only life with which we are intimately acquainted) is a correlation of irritable tissues. We may have in our body organs which are apparently healthy, but there may be one small organ, e. g., the pituitary body, which is diseased, and although the condition may be unknown, there is a great loss in correlation of the entire body. In regard to the investigations mentioned by Dr. Wahrer the most recent commentators are of the opinion that the results of some of the experiments are not as given by the investigator himself; that many mistakes have been made in the conclusions. The investigations in the animal kingdom at the present time are very interesting. We accept the conclusions of Burbank for the vegetable kingdom; but as in the animal kingdom the high and low forms of life are very different, so there is still a greater difference between the vegetable and animal forms of life.

That which concerns physicians most is the transmission of characteristics of physical conditions from the parent to the child, which will be for the betterment of the community. Many teach that the child who is born in the hovel of parents who are drunkards or degenerates will be a degenerate; not because of the environments, but because of the parentage. This he does not accept. While we should accept the teaching of Dr. Holmes on the preparation of a child many years in advance of its birth, yet he believes that the environment in which we live has much to do with what we ourselves or our children shall be. An illustration of this is seen in a young man who has passed from the country to the city. He has been virtuous and all the community has considered him such. When he reaches the city and becomes associated with companions of bad habits he may change completely. If the young man had the acquired characteristics which were stable and which would be permanent throughout his life, why should he, when placed in different environment, become different? Dr. Rhodes thinks children will be in accord with the environments in which they live. He studies this subject for the pleasure it gives, but is no nearer the solution at the present time than when he began, nor does he ever expect to be.

DR. D. S. HANSON, Cleveland, Ohio, called attention to the rapid changes due to environment. For instance, it takes years and years of careful selection of seed, as in raising corn, and requires good soil to produce an ear of corn with the requisite number of seeds to cover the cob. Yet that good seed, planted successfully for a number of years, if placed in poor soil will produce a corn-cob not covered with seed. In other words, poor environment will soon destroy all that was gained by heredity. This will work out also in the animal kingdom. We see horses bred for years and a great speed developed. If such a horse is put into a plow and given the same surroundings as

an ordinary horse and all training stopped, in the course of two or three generations there will be a breed incapable of development as were the former ones. In other words, environment makes rapid changes, but the changes of heredity are slow.

DR. R. B. GILBERT, Louisville, Ky., agreed that the subject of maternal impressions is a big one. He believes that it is well established that accidents to the fetus in utero result from impressions made on the mother or even from traumas. He had hoped that Dr. Wahrer would make it plain just how these maternal impressions exist and what is the physiologic law governing them.

DR. G. E. ROBBINS, Chillicothe, Ohio, said that he can not believe in heredity further than as a reproductive function. He can not but feel that it is environment that develops the race as we see it. If this were not true we would not be so careful of our children. As parents, said he, we are extremely careful how we rear them and how they are placed. Outside of the purely physical characteristics that may be transmitted he has no faith in heredity, but he does believe in environment.

DR. M. E. DUNNING, Newburgh, N. Y., referred to the children of the blind and deaf. Blindness is much less frequently transmitted to the offspring than deafness. More parents are born deaf than blind. A few years ago in certain statistics it was found that about 10 per cent. of the children were born blind and that the majority of parents had acquired their blindness through accident or disease. It was found that the blindness which had been acquired by the parents was transmitted so seldom to the offspring that it seemed almost an accident when it did occur.

DR. WAHRER said his paper was certainly liable to misconceptions. He wanted to make himself clear on the point of maternal impressions. He does not believe in them in the usual understanding of the term, and they can not be substantiated except by the most careless, unscientific, hear-say evidence. The first thing many mothers ask is, "Doctor, is the child marked?" If a child is born with a deformity some one is sure to believe that the father or mother has been guilty of some sin or indiscretion. Why should the innocent one be punished? Dr. Wahrer does not believe in the idea, and the trend of medical education is away from it.

His paper was not intended to be a full treatise on heredity. It has been said that certain diseases are hereditary, but this idea is fifty years behind the time. Tuberculosis is not hereditary. We don't know whether cancer is inherited. The same thing is true of many diseases of the child. He said a study of this subject by every pediatricist would give him a different viewpoint on many things pertaining to the child and would be to the mutual betterment of the child and its medical attendant.

A FURTHER CONTRIBUTION TO THE STUDY OF STOOLS OF STARCH-FED INFANTS.*

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The work was undertaken with a view to adding to our information of the digestive capacity of infants for starch foods, a subject on which we have had many and varying expressions of opinion, based on clinical observations.

All the infants on whom tests were made were inmates of the New York Infant Asylum. The advantage of making such a study in institution children is obvious, when we remember that the feeding of such patients (the amount of starch given, for example) can here be kept in perfect control. Further, the test is more se-

* Read in the Section on Diseases of Children of the American Medical Association, at the Fifty-seventh Annual Session, June, 1906.